monomeric mixture, commercially available as BL59 containing 25%CB15 and 20%CC6. At a temperature of 30°C nearly all light between ca. 450 and ca. 500 nm is reflected by the cholesteric liquid crystal. At 35°C the aforementioned wavelength are crossing the material and wavelengths between ca. 500 and ca. 550 nm are reflected. At 55°C wavelength between ca. 570 and ca. 630 nm are reflected all other wavelengths transmit the cholesteric liquid crystal.

It is essential for the invention that the wavelength of the laser beam 9 and the intensity of the laser beam 9 in the focal spot 10 on the one hand and the type of liquid crystal in the cholesteric phase on the other hand are selected referring to each other. A usable read-out power is 5 mW for a 405 nm laser. At ambient temperature the cholesteric phase has to be transparent for the wavelength of the laser beam 9. The laser beam 9 is focused onto a focal spot 10. The cholestric phase in the optically active material spots 4 exposed to the focal spot 10 is heated above a reflection threshold temperature. At that temperature the cholesteric phase reflects the laser light 9. The reflected laser light can be detected and evaluated.

In order to get a sufficient reflection intensity the cholesteric phase layer should be as thick as possible. Fig. 6 shows a diagram with the maximum reflectance plotted as a function of layer thickness for different refraction indices. In Fig. 6 it can be seen that a reflectance of more than 40% can be obtained for a sample with a thickness of ca. 800 nm. The calculation for the diagram is valid for light in one circular polarization state. When unpolarized light is used reflectance is decreased by a factor of two.

For the multi-layer disc 1 there are some requirements regarding the absorption and the transmission of the in-focus information layer 11 and the out-of-focus information layers due to signal fan-out of the signal intensity for the deeper lying layers. The absorption of the out-of-focus information layer should be <2% and the absorption of the in-focus information layer should be sufficient to increase the temperature above the reflection threshold temperature, e.g. 200°C. Another requirement refers to the track width. If laser light of 405 nm is used and the numerical aperture of the objective lens 12 is NA= 0.6 a track width of 400 nm is needed.

There are different ways to manufacture the disc 1 containing cholesteric phase. A substrate with the necessary pit distribution can be used. The pits can be filled using spin coating.

A second method to produce a disc 1 with the necessary distribution of cholesteric phase is surface treatment according to Figs. 9a and 9b. Predetermined areas 17 of

the surface are selected and treated in Fig. 9a. After having done the surface treatment the cholesteric phase is applied to the treated surface and deposits on the untreated areas producing the required cholesteric phase spots 4 shown in Fig. 9b.

Thirdly, a cholesteric phase changing its pitch under the influence of UV radiation and/or heat can be used according to Figs. 10a, 10b, 10c. A substrate 18 can be deposited with a cholesteric phase layer 19 and a template 20 can overlay the deposited cholesteric phase layer 19. UV radiation or heat is emitted onto the template and changes the pitch of the cholesteric phase underneath transparent areas of the template 21 as shown in Fig. 10b. Finally the treated cholesteric phase layer 19 is fixed by flood exposure according to Fig. 10c.

Unwritten discs containing grooves filled with cholesteric phase can be written by exposing them to a writing laser beam with an intensity to degrade predetermined areas. The degraded cholesteric phase permanently looses its Bragg characteristics. A usable writing beam power is 20 mW for a 405 nm laser. As a result tracks of sections containing cholesteric phase and sections containing degraded material are obtained with the information stored in the sequence of cholesteric phase and degraded material along the tracks.

In a second embodiment of the invention Bragg reflectors are made of alternating layers 15, 16 with different refractive indices n_1 and n_2. A layer 15 with a refractive index n_1 and an adjacent layer 16 with a refractive index of n_2 have a thickness of d as shown in Fig. 7. Such Bragg reflectors can be obtained by using block copolymers which show lamellar phase. For a Bragg reflector with negative reflection coefficient the position of the reflectance band 14 moves from higher to lower wavelength with increasing temperature as shown in Fig. 8a. Bragg reflectors with positive reflection coefficient show the reverse characteristic as shown in Fig. 8b. There the reflectance band 14 moves from higher to a lower wavelength with decreasing temperature. An appropriate choice of the laser beam wavelength is indicated by the two arrows λ_{laser}.

In current multi-layer discs fluorescent material is used to store information. Fluorescence is isotropic resulting in a low collection efficiency of such systems. To improve the collection efficiency Bragg reflectors can be used as storage material. Bragg reflectors reflect signals instead of absorbing incident light and emitting light of a different wavelength. The reflected signals are directed and have a higher intensity improving the collection efficiency.

CLAIMS:

1. Optical information carrier (1) for carrying information to be read out by means of an optical beam (9) comprising:

at least one information layer (6) containing material having Bragg reflector characteristics for reflecting light of said optical beam (9), when said material is heated above a reflectance threshold temperature by said optical beam (9).

2. Optical information carrier (1) as claimed in claim 1, characterized in that said material contains liquid crystal.

3. Optical information carrier (1) as claimed in claim 1, characterized in that said material contains cholesteric liquid crystal.

4. Optical information carrier (1) as claimed in claim 1, characterized in that said material contains liquid crystal in the blue phase.

5. Optical information carrier (1) as claimed in claim 1, characterized in that said material contains alternating layers (15, 16) with different refractive indices.

6. Optical information carrier as claimed in claim 5, characterized in that each layer (15, 16) contains block copolymers.

7. Optical information carrier as claimed in claim 1, characterized by at least two information layers (6) and at least one spacer layer (7) separating said at least two information layers (6) and being transparent for said optical beam (9).

8. Read-out device for reading out information from an optical information carrier (1), which comprises at least one information layer (6) containing material having

Bragg reflector characteristics for reflecting light of an optical beam (9), when said material is heated above a reflectance threshold temperature, comprising:

a light source emitting said optical beam (9), which can be directed onto said optical information carrier (1), producing a temperature above said reflectance threshold temperature.

9. Read-out device as claimed in claim 8, characterized by focussing means (12) for focusing said optical beam (9) on a focal spot (10) having a temperature above said reflectance threshold temperature on said at least one information layer (6).

10. Read-out device as claimed in claim 8, characterized by at least one detector for detecting light reflected by said material having Bragg reflector characteristics.

11. Writing device for writing information on an optical information carrier (1), which comprises at least one information layer (6) containing material having Bragg reflector characteristics comprising:

a light source emitting an optical beam (9) to be directed onto said optical information carrier (1) for changing reflection characteristics of said material.

12. Writing device as claimed in claim 11, characterized in that said optical beam produces a temperature above a degrading temperature threshold of said material for degrading said Bragg reflector.

13. Writing device as claimed in claim 11, characterized by focussing means for focusing said optical beam (9) on a focal spot (10) on said at least one information layer.

14. Method for reading out information from an optical information carrier (1), which comprises at least one information layer (6) containing material having Bragg reflector characteristics for reflecting light of an optical beam (9), when the material is heated above a reflectance threshold temperature comprising the steps of:

directing said optical beam on said information carrier for heating said material above said reflectance threshold temperature,

detecting signals being reflected by said heated material and

evaluating said detected signals.

15. Method as claimed in claim 14, characterized by focusing an optical beam (9) on a focal spot (10) in one of said information layers (6) for heating said material above said reflectance threshold temperature.

16. Method for writing information on an optical information carrier (1), which comprises at least one information layer (6) containing material having Bragg reflector characteristics comprising the steps of:

directing an optical beam (9) on said optical information carrier (1) for changing reflection characteristics of said material.

17. Method as claimed in claim 16, characterized by heating said material above a degrading temperature threshold of said material degrading said material.

18. Method as claimed in claim 16, characterized by focusing said optical beam (9) on a focal spot (10) on said at least on information layer for heating said material above said degrading temperature threshold.